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BOTTOM-UP CONTROL OF SARDINE AND ANCHOVY POPULATION CYCLES IN THE CANARY CURRENT: INSIGHTS FROM AN END-TO-END MODEL SIMULATION

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Abstract: Sardine and anchovy can exhibit dramatic decadal-scale shifts in abundance in response to climate variability. Sharpe declines of these populations entail particularly serious commercial and ecological consequences in eastern boundary current ecosystems, where they sustain major world fisheries and provide the forage for a broad variety of predators. Understanding the mechanisms and environmental forcing that drive the observed fish variability remains a challenging problem. The modelling study presented here provides an approach that bridges a comprehensive database with an end-to-end modelling framework enabling the investigation of the sources of variability of sardine and anchovy in the Canary Current System. Different biological traits and behaviour prescribed for sardine and anchovy gave rise to different distribution and displacements of the populations, but to a rather synchronous variability in terms of abundance and biomass, in qualitative agreement with historical landing records. Analysis of years with anomalously high increase and decline of the adult population points to food availability (instead of temperature or other environmental drivers) as the main environmental factor determining recruitment for both sardine (via spawning and survival of feeding age-0 individuals) and anchovy (via survival of feeding age-0). Consistent with this, the two species thrive under enhanced upwelling-favourable winds, but only up to some threshold of the wind velocity beyond which larval drift mortality exceeds the positive effect of the extra food supply. Based on the analysis of the simulation, we found that anchovy larvae

are particularly vulnerable to enhanced wind-driven advection, and as such do better with more moderate upwelling than sardines.

Key words: physical-biological interactions, small pelagic fisheries, eastern boundary currents, biophysical models, end-to-end models

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